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# WAR WITH THE OSPREY: TECHNOLOGY AND THE LIMITS OF VISION IN WARFARE



by

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A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College, the Department of the Navy or the United States Marine Corps.

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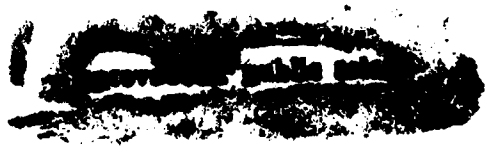

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**Abstract of**
**WAR WITH THE OSPREY:**
**TECHNOLOGY AND THE LIMITS OF VISION IN MODERN WARFARE**

The development of tiltrotor aircraft, specifically the V-22, is analyzed as a revolutionary technology and is compared with the development of similar technology from military history. The role and relative importance of technology in modern warfare is discussed in the context of Clausewitzian theory. The inability of governments and military organizations to easily assimilate revolutionary innovations is highlighted. Factors such as doctrine and rigid organizational thinking, among other things, are identified as sources of resistance to innovation. As a result, revolutions in warfare, as exemplified by such innovative weapons as the machine gun, tank and airplane, have not been recognized and employed early in the development cycle. The V-22, also an innovation of historical proportions, has suffered a similar fate for remarkably similar reasons..

## PREFACE

This paper was written with three things in mind. First, the V-22 *Osprey* program has been a center of controversy for many years and its future will be decided, for better or worse, by the procurement system that controls its fate. Another "sales pitch" in this document, however accurate, would do little to help insure the aircraft's future. Second, the tiltrotor represents a technological breakthrough and, for a variety of reasons, military planners throughout history have routinely failed to recognize and seize the advantages such breakthroughs have provided. And third, the latter statement will be particularly true for the V-22. An experimental concept in the 1950's, a proven technology in the 1970's, and a full scale prototype in the 1980's, the V-22 will not be fielded in a combat unit in this century. This delay has occurred primarily due to biases encountered in politics, funding competion, service rivalry, weapon system proponency and a prevailing narrow view of the aircraft as simply a lowly helicopter replacement. When the V-22 enters service, an entirely new generation of military planners will have to overcome both a false sense of familiarity and this long history of bias to properly employ the aircraft. These limits to vision may doom them to repeat history and deny future battlefield commanders full use of this revolutionary weapon.

TABLE OF CONTENTS

# CHAPTER I

## INTRODUCTION

PROLOGUE. ***"Any sufficiently advanced technology is indistinguishable from magic."*** Arthur C. Clarke.

> For I dipped into the future, far as human eye could see,
> Saw the Vision of the world, and all the wonder that would be;
> Saw the heavens fill with commerce, argosies of magic sails,
> Pilots of the purple twilight, dropping down with costly bales;
> Heard the heavens fill with shouting, and there rained a ghastly dew
> From the nations' airy navies grappling in the central blue.[1]
>
> Alfred, Lord Tennyson

By the summer of 2004, the CIA had gathered enough concrete intelligence to confirm both the existence and location of Iran's prototype nuclear weapons production facility. In light of Iran's increasing efforts to lure the new Islamic nations of Central Asia into its camp, the President of the United States was quick to act on this information. A flight of four Marine V-22's containing a forty-man Special Operations Force was launched from an LHD operating at night in the Gulf of Oman. Escorted by a flight of stealth fighters launched from Saudi Arabia, the Osprey's flew below radar coverage and navigated to their objective by infrared sensors and satellite positioning. In two hours the aircraft covered the 600 miles to

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[1] From Tennyson's "Locksley Hall", l. 119 (1842), quoted in Bartlett's Familiar Quotations (CD-ROM: Microsoft Bookshelf, 1993 edition).

their destination. The guards in the compound did not hear the quiet tiltrotors approach until it was too late. A non-lethal gas released on the first pass by the lead Osprey rendered all personnel outside the compound instantly unconscious. The other three aircraft landed before the lead V-22 finished its turn back to the compound. Combat troops quickly entered the building and put all occupants in the same state as the sleeping guards outside. Evidence of nuclear weapons production was abundant and key pieces were gathered rapidly. The former Russian nuclear scientist was an unexpected bonus. After destroying irreplaceable equipment in the facility, the team left the building with their evidence and a new "passenger". Fifteen minutes after landing all aircraft were airborne again. Neither side had sustained any casualties. The Ospreys joined their KC-130 tanker just after "feet wet" and refueled to continue the flight back to the LHD.

After viewing the evidence, including the testimony of a well-known Russian scientist, Russia eagerly joined the U.S. and Pakistan in a complete economic blockade of Iran under a U.N. sanction. Through Russian, Turkish and Saudi influence, the Islamic nations of Central Asia were also soon persuaded to join the U.N. blockade. After a year of isolation and internal conflict, the militant Islamic government of Iran collapsed.

## THE UNDISCOVERED COUNTRY.

The preceding futuristic story is just one example of how the V-22 may be employed in the years to come. Such a future, however, may never come to pass. After a painful, twenty-year history of delayed development, recent reductions in military spending do not bode well for this aircraft. It must compete with a variety of evolutionary programs, such as upgrades to conventional aircraft, in order to survive. If such decisions were based simply on the merits of new weapons as compared to the old, the future of the V-22 would not be in doubt. But history shows that such rational decisions are unusual and points to many underlying reasons for such outcomes. In a century where technology has produced weapons to conduct global war, new surprises in military weaponry are not always welcome. But this may be overstating the situation. More appropriately, mankind has displayed an inability to see the potential in new technology. And, even after recognizing such potential, many organizations avoid a commitment to technological development due to the perceived risks and the threat that such innovations represent to the comfortable status quo. Shakespeare identified this very human reaction to death, uncertainty and the unknown which he called:

> The undiscovered country from whose bourn
> No traveler returns, puzzles the will,
> And makes us rather bear those ills we have
> Than fly to others that we know not of?
> Thus conscience does make cowards of us all;

And thus the native hue of resolution
Is sicklied o'er with the pale cast of thought,
And enterprises of great pith and moment
With this regard their currents turn awry,
And lose the name of action[2].

Tiltrotor technology, specifically the V-22, has been approached as an "undiscovered country" by almost everyone involved with the military procurement system. As the following research attempts to show, the V-22 shares this distinction with some of the most important developments in the history of military technology. Additionally, the possibility that the employment of tiltrotor aircraft may alter current military doctrine is very real since it is truly a revolutionary weapon, "an enterprise of great pith and moment."

## CHAPTER II

## TECHNOLOGY'S PLACE IN MODERN WARFARE

### THEORY AND REALITY.

"Surprising as the fact may appear to modern eyes," Martin Van Creveld once wrote, "none of the classical military writers paid much attention to technology."[3] Clausewitz, in developing his theory of war, was not troubled by the impact of

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[2] From William Shakespeare's "Hamlet", Act: III, Scene: i, Line: 56, quoted in Bartlett's Familiar Quotations (CD-ROM: Microsoft Bookshelf, 1993 edition).

[3] Martin van Creveld, Technology and War (New York: The Free Press, 1989), p. 321.

technology on warfare for at least three reasons. First, although scientific advances had slowly shaped the character of war even in Clausewitz' time, he saw the underlying motivations as more important:

> The invention of gunpowder and the constant improvement of firearms are enough to show that the advance of civilization has done nothing to alter or deflect the impulse to destroy the enemy, which is central to the very idea of war.[4]

Second, he constructed his work at the dawn of the Industrial Revolution. Although some important inventions, steam propulsion for instance, did exist, these devices did not make an impact on warfare until after his death (1831).[5] And third, as he explained his incomplete work in 1818, "It was my ambition to write a book that would not be forgotten after two or three years".[6] In other words, what Clausewitz saw as important in the time of Bonaparte was not the transitory, minor effects of crude technology, but the timeless, elemental interaction of people, armies and governments. In his time the French Revolution had spawned both the *levee en masse* and the genius of Napoleon. War was no longer the clean duel of small, professional armies. Whole nations took up arms under military leaders who were

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4 Carl von Clausewitz, On War (Princeton: Princeton University Press, 1984), p. 76.

5 Michael Handel has written a brief but excellent note on this subject in his essay "Clausewitz in the Age of Technology" in Makers of Modern Strategy, a volume which he edited (see note 7, p88).

6 Clausewitz, p. 63.

forced to learn how to use such vast manpower to survive against the would-be Napoleons. All available national resources were diverted to the contest. War had become a world-shaping, nation-destroying force that required strong political leadership to control it. In a period of such revolutionary changes in the scale of warfare, it is understandable that, to Clausewitz, small refinements in weaponry paled by comparison. Or, as Michael Handel put it, in "[t]rying to reduce his argument to its essence, Clausewitz chose not to emphasize material considerations in the explanation of war."[7]

To describe the dominant characteristics of war that he distilled, Clausewitz created the concept of the "trinity". The worth of this concept remains unchallenged even in the context of modern warfare.

> War is more than a true chameleon that slightly adapts its characteristics to the given case. As a total phenomenom its dominant tendencies always make war a **paradoxical trinity**- composed of primordial violence, hatred, and enmity, which are to be regarded as a blind natural force; of the play of chance and probability within which the creative spirit is free to roam: and of its element of subordination, as an instrument of policy, which makes it subject to reason alone.
>
> The first of these three aspects mainly concerns **the people**; the second **the commander and his army**; the third **the government**. The passions that are to be kindled in war must already be inherent in the people; the scope which the play of courage and talent will enjoy in the realm of probability and chance depends on the particular character

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[7] Michael Handel, ed., Clausewitz and Modern Strategy (Totowa, NJ: Frank Cass & Co. Ltd.), p. 59.

> of the commander and the army; but the political aims are the business of government alone.
>
> These three tendencies are like three different codes of law, deep-rooted in their subjects and yet variable in their relationship to one another[8]

Clausewitz' final analogy on these three aspects of war not only summarizes what his theory attempts, but best describes the relationship between the parts of the trinity. "Our task is to develop a theory that maintains a balance between these three tendencies, like an object suspended between three magnets".[9]

But what is technology's place in this classic theory of war? How has modern weaponry altered the relationships Clausewitz brilliantly described in his trinity? In his essay, "Clausewitz in the Age of Technology", Michael Handel states "[d]espite the critical importance of technology in military affairs, very little theoretical work has dealt with this subject."[10] To account for technology in modern warfare, Handel proposes a modification to Clausewitz' trinity.

> In view of the central importance of military technology to all aspects of contemporary warfare, we can assume that if Clausewitz were alive today, he might well propose a four-variable analytical framework with the material realm [*technology and economy*] as the fourth dimension.[11]

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8 Clausewitz, p. 89.

9 Ibid.

10 Handel, ed., p. 72.

11 Ibid., p. 59.

Handel describes this modification as "squaring the triangle"[12], and this certainly puts technology in a proper place of importance. But Clausewitz' metaphor of the magnets provides a simpler tool to explain the effect of technology on his trinity. If these elements of war are like three magnets, then technology provides a new source of power for these magnets. Since military technology was rudimentary and equally available to all combatants in Clausewitz' day, the pervasive force exerted by technology was relatively weak and unimportant. But in the modern world, technology acts so strongly on Clausewitz' trinity that the magnets have become superconductive.

The people have instant access to events and know the underlying motives of the conflict through modern communications. Their minds and emotions have become more than just fuel for the struggle. Combatants value the will of the people as much as any other political objective and must act to win and hold popular support.

The military has available an awesome array of weapons that can be used in endless combinations to achieve national objectives, in war and peace. Time, distance and resource limits are largely offset by military technology, but reactive political leaders constrain these weapons to narrow limits while demanding decisive

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12 Ibid., p. 58.

action. Military doctrine falls further and further behind as new missions and new technologies are created.

The government must act in a global theater with a script that changes constantly. Every move is questioned and swayed by the world press, national and international organizations, and the voting citizenry. Each of these pressure groups has access to vital information just as quickly as the leaders who are attempting to act on it. More often than not, because of the technology it employs, the modern military is the statesman's tool of choice for handling a crisis.

The end result is that war has become more complicated, deadly, sudden and difficult to define by historical standards. With technology, war has again asserted itself as "more than a true chameleon" that has adapted its nature to the tools available. All three aspects of Clausewitz' trinity are substantially effected and now interact in new ways. How the people view war, how the commander and his army wage it, and how the government controls it has been dramatically altered. In a world that has experienced the devastation of two world wars and the Cold War, advanced nations are no longer willing to wager lives and economic well-being in an all-or-nothing conflict when technology can provide an alternative. Ideas, especially scientific ideas, are unlimited and can be selectively developed to match

the needs and resources of the nation. Thus, technology has become the only unlimited resource of war and is a dominant influence in modern conflicts.

FAILURES OF VISION. ***"Aeroplanes and tanks... are only accesories to the man and the horse, and I feel sure that as time goes on you will find just as much use for the horse...as you have ever done in the past."*** Field-Marshall Haig, 1926.[13]

Americans pride themselves in the exploitation and use of technology on the battlefield. History shows that neither America nor the rest of the world is very good at recognizing technological advantages and then applying these advantages to gain battlefield victories early in a conflict.

Moltke once described the American Civil War as "two armed mobs chasing each other around the country, from which nothing could be learned."[14] But as J.F.C. Fuller correctly pointed out, "the main characteristic of this war was the extraordinary inventiveness displayed throughout it."[15] The Civil War produced many important advances in military technology, but Gatling's machine gun was arguably the most important First demonstrated in 1862, the weapon's potential was not recognized by the military and, as a result, these guns were never purchased in large quantities until after the war ended. Even after the Gatling gun became a part

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[13] Field-Marshall Haig, quoted in John Ellis, The Social History of the Machine Gun (New York: Pantheon Books, 1975), p. 17.

[14] Helmut von Moltke, quoted in J.F.C. Fuller, Armament and History (New York: Charles Scribner's Sons, 1945), p. 117.

[15] J.F.C. Fuller, Armament and History (New York: Charles Scribner's Sons, 1945), p. 117.

of the military inventory, its obvious advantages were overlooked. In 1876 the U.S. Army had a version that was specially designed for cavalry use. Capable of 1000 rounds per minute, the gun could be fired from horseback or from the ground on a tripod. On the day that George Custer led his cavalry to final glory at the Little Big Horn, he left four of these weapons behind with his headquarters.[16] Custer was not alone in his neglect of this weapon. George Chinn made the following observation on this period of American history:

> The United States, however, was in the midst of peace...The old-line military men were still not inclined to accept anything as revolutionary as the Gatling. Although it is recorded that each detachment in the field had several of these guns on its allowance list, nothing can be found to show their use in the Indian warfare of the Western plains.[17]

Like Moltke, British observers of the Civil War were no better at deciphering the lessons technological advances provided so that these could be applied in the operational art. After watching a demonstration of Gatling's invention in 1862, three British officers submitted the following report:

> We saw some practice at 250 yards range against a target, with this gun, which was very bad; this appeared to be the fault of the ammunition...It fired with great rapidity, but soon got out of order...It might be useful in the defence of a narrow passage or bridge, but it is questionable whether it would be of any great practical utility in the open field of battle.[18]

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[16] George M. Chinn, The Machine Gun (Washington: US Government Printing Office, 1951), v. 1, pp. 48-59.

[17] Ibid., v. 1, p. 58.

John Ellis sums up this lack of vision: "Granted that the ammunition was defective one might have thought that the officers would have been able to...imagine the effect such a weapon might have if it was using reliable cartridges."[19]

The history of the machine gun is replete with such examples. The French fielded a version, called the *mitrailleuse*, during the Franco-Prussian War (1870-1871), but their secrecy and blind determination to employ the weapon as artillery helped insure a humiliating defeat. The Russo-Japanese War (1904-1905), in which both sides were amply supplied with Maxim and Hotchkiss guns, provided ample warning to the world that a revolution in warfare had occurred. Some did not heed this warning. Others did, but not well. This led to the slaughter of World War I on which Ellis wrote:

> For military reactions to the machine gun were not a rational response to either technical or financial considerations. They were rooted in the traditions of an anachronistic officer corps...They still thought that they would fight on the battlefields on which man was the dominant factor...Such men could not admit that a mere machine had robbed them of their old primacy. Thus they ignored it. For the British commanders on the eve of the First World War the machine gun simply did not exist.[20]

Ellis further relates the prevailing attitude of the leadership in the British

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18 Ellis, pp. 62-63.

19 Ibid., p. 63.

20 Ellis, pp. 63-70.

Expeditionary Force upon arrival in France in 1914. Armed with few machine guns and even fewer trained gunners, "a junior officer would inevitably ask, 'What should I do with the machine guns today, Sir?' The equally inevitable reply would be, 'Take the damned things to a flank and hide them.'"[21]

America entered that war at least as unprepared. Our nation was the birthplace of such inventors as Gatling, Maxim and Lewis, but U.S. troops carried none of their inventions into combat. The sole exception was the Lewis gun held by the Marines:

> When these [Marine] divisions arrived in France they were attached to Army units and put under the command of the latter. As soon as this happened they were ordered to turn in their Lewis guns and be re-equipped with the notorious [French] Chauchat...which, has been seen, the French chose to regard as a machine gun and the Americans threw away as so much scrap metal.[22]

World War I produced a number of revolutionary weapons that, in time, changed the face of warfare as much as the machine gun. Although it came late in the war, the tank allowed the Allies to breach German trenches which led to many tactical, if not strategic, successes. The war ended before the Allies realized the full potential of this weapon and, while the victors dismantled their armies, the debate as to the tanks ultimate use continued. But the German military put the lessons learned in WWI to effective use. The Wehrmacht saw the potential of such a technical

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21 Ibid., p. 69.

22 Ibid., p. 76.

revolution and created the blitzkrieg to take advantage of it. As a result, the Allies fell victim to their own invention in the hands of an enemy with superior vision.[23]

The airplane suffered a similar fate in WWI. Although the leaders of the time knew that this revolutionary technology could be applied in war, they could not see past the airplane's immediate use for observation to explore its full potential. Even on the eve of WWII, after years of peacetime debate had altered some of these narrow perceptions, military planners still believed that an unescorted bomber, specifically the B-17, could reach targets deep in enemy territory. Attempts at the daylight bombing of Germany proved them wrong and the Allies were not successful in this strategy until the P-51 was developed as a bomber escort.[24]

World War II provides one of the few examples where vision led the development of revolutionary technology. The V-2 was a civilian creation that, impelled by the drive of the German war industry and Hitler's imagination, changed warfare forever.[25] No one at the time could have foretold that this rocket would one day lead to the inter-continental ballistic missile and space exploration. But

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[23] Van Creveld, pp. 177-179.

[24] Thomas H. Greer, The Development of Air Doctrine in the Army Air Arm, 1917-1941, USAF Historical Study, no. 89 (Maxwell Air Force Base: Air University, 1955; reprint ed., Air University, 1985), pp. 82-83.

[25] Van Creveld, pp. 76, 221-222.

with the exception of the V-2, great innovations, like the great prophets, are rarely recognized in their own time or in their native land.

THE FOG OF DOCTRINE. ***"Men will not believe what does not fit in with their plans or suit their prearrangements."*** Barbara Tuchman.[26]

Joint Pub 1 states that doctrine "provides the distilled insights and wisdom gained from our collective experience with warfare."[27] Doctrine is an essential part of military operations since it provides the script that coordinates the actions of all participants. But does strict adherence to established doctrine obscure and limit, like a self-generated fog, the imaginative use of new technology by the military? Are we so focused on what must be that we cannot see what may be? Martin van Creveld offers some insight on these questions:

> During the twentieth century...none of the most important devices that have transformed war -from the airplane through the tank, the jet engine, radar, the helicopter, the atom bomb, and so on all the way down to the electronic computer- owed its origins to a doctrinal requirement laid down by people in uniform...[28]

Civilians unencumbered by military doctrine often see the potential of new weapons more clearly than the military. In 1862, after a demonstration of the Gatling gun, a local newspaper commented, "They ...can be made so important

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[26] Barbara W. Tuchman, quoted in Peter Schwartz, The Art of the Long View (New York: Doubleday, 1991), p. 35.

[27] U.S. Joint Chiefs of Staff, Joint Pub 1, Joint Warfare of the U.S. Armed Forces (Washington: National Defense University Press, 11 Nov 1991), p. 5.

[28] Van Creveld, p. 220.

...that it does seem strange to us that the Government has not long since ordered a large number of them."[29] Winston Churchill, an "eccentric civilian", had the vision as early as 1915 to make funding available so that the tank could be developed beyond the prototype stage.[30]

Even a brief look through any current military doctrine will reveal that, of necessity, such documents rely on principles of war for a foundation. In his book Fleet Tactics, Wayne Hughes compares two lists of the principles of war compiled from the works of prominent military writers throughout history, from Sun Tzu to Hayward. He adds the following comments:

> But I find the differences, both within and between the two lists, as instructive as the similarities and therefore worthy of comment. It is fascinating to contemplate the reasons for these differences:
> - The age and maturity of the author...
> - The historical period...
> - The social milieu...
> - The emphasis on tactics, strategy, or both...
> - The author's experience or viewpoint...
> - The military milieu...[31]

In a final parenthetic comment on the last, the military milieu, Hughes observes that

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29 Ellis, p. 71.

30 Van Creveld, p. 222.

31 Wayne P. Hughes, Jr., Fleet Tactics (Annapolis: Naval Institute Press, 1986), pp. 290-296.

"no author has emphasized air or amphibious warfare" in selecting his principles of war.[32] This is indeed instructive and is one indicator of why, with current doctrine, we do not fully realize the impact of the V-22, a weapon that provides vast depth to both air and amphibious warfare.

Doctrine often aggravates the short-sighted tendency to fit new technology into old roles rather than explore new opportunities created by innovation. The tank in WWI and the aircraft carrier at the beginning of WWII are just two examples. The current view of the V-22 as simply a replacement for the helicopter has been institutionalized by doctrinal requirements and rigid thinking. From an historical perspective, such mindsets are a large part of operational failures and, in the case of the V-22, will put future operational planners at a disadvantage. Military doctrine must be dynamic and capable of reacting to changes in world politics and science. It is through constant review of doctrine that the military can identify inherent weaknesses and seek solutions in, among other things, technology.

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[32] Ibid., p. 296.

TILTROTOR: REVOLUTION, NOT EVOLUTION. ***"If you produce this aircraft, I guarantee you we will buy it. If you do not, I guarantee you we will build it."*** Japan's Minister of International Trade and Industry (MITI) on the V-22, 1990.[33]

U.S. military forces depend upon a procurement system that has been developed over many years and, for the most part, reflects the thinking of the people who man it. As a means of maintaining a modern military, this system has no equal. But even here the channelized thinking exhibited in doctrine plays a major role. Like doctrine, military procurement deals much easier with what has been rather than what might be. As a result, the procurement system is very good at producing incremental improvements to existing weapons, but less capable of handling revolutionary technology. This is not so surprising when one considers that, arguably, the only revolutionary technology that the current system has handled since the Vietnam War has been the computer.[34] But this incremental approach to modernization leads to ever-diminishing returns and technological dead ends. The current inventory of aircraft, including the B-2, F-117, F-18 and most of the new helicopters, may represent the ultimate in their category of weaponry. No similar armament held by any other country can come close in capability, nor can those countries hope to develop such weapons without committing their entire gross

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[33] MITI, quoted in Dean G. Sedivy, Bureaucracies at War: The V-22 Osprey Program (Alexandria, VA: Defense Technical Information Center, 1992), p. 24.

[34] Van Creveld makes somewhat the same case (p. 277).

national product to the effort. But what is the return on investment in such "ultimate" weapons for the U.S.? Do such investments really compare with the advantages that an entirely new technology can provide? On the one hand they are indeed the technological high ground that no one else can seize. But on the other hand, these weapons represent a vast accumulation of knowledge gleaned from decades of expensive research and development, refinements piled upon refinements, until expense severely limits production and specialization restricts the weapons to very limited roles. Like Icarus, we have pushed the envelope of current technology beyond which we cannot reasonably go. Further attempts at improvement can only come at the expense of new technology that needs to be developed.

Our current inventory of weapons reflects the United States' transition to a smaller, professional military since Vietnam. To offset the quantitative disadvantages of this philosophy, America has relied on overwhelmingly superior armament. But, as Steven Canby has noted, "technological solutions to force imbalances are practical only if revolutionary technologies can be periodically introduced."[35] Tiltrotor technology offers just such a revolution and, even though the initial cost will be high, this will not be true in the long run:

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[35] Jonathan Alford, ed., The Impact of New Technology (Montclair, NJ: Allanheld, Osmun & Co. Publishers, Inc., 1981), p. 17.

> ...innovative technology always costs more than imitative technology, and...the cost of improving any aspect of technology at a steady rate increases with time [*but*] marginal improvements in mature technology tend to cost more and take longer than major improvements in a new technology...[36]

Tiltrotor aircraft have a number of basic characteristics that have never been combined in a single platform before. Taken individually, none of these characteristics is very remarkable. Perhaps this is one reason that the aircraft, like so many innovations before it, is taken for granted. Its maximum speed is twice that of the helicopter and surpasses most modern propeller aircraft. Like turboprop aircraft, it can operate above 20,000 feet and remain aloft for about the same amount of time. This results in a flight range more than double the helicopter, before conducting aerial refueling. And most important of all, the tiltrotor can carry troops and land in small, unimproved areas just like the helicopter. This increase in capabilities over the helicopter represents a leap in technology as great as the jet over the propeller aircraft in WWII.

The tiltrotor will provide a new array of options to future operational planners. To cite a few examples, consider how some recent military actions would have been executed with the V-22. The episode of Desert One helped rewrite joint doctrine. But one of the lessons that should have been learned is that conventional

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[36] Ibid., pp. 16-17.

technology could not meet all the demands of our national interests. The success of the Iran raid would have been nearly certain if the V-22 had been available. Prior to the initiation of Operation Restore Hope in Somalia, an extremely difficult emergency evacuation of the American embassy in Mogadishu took place. This mission was accomplished at the last minute and at high risk by helicopters, whereas, tiltrotor aircraft could have accomplished it with ease. Had the helicopters been further away, or the embassy further inland, the mission could not have been attempted at all. Other possibilities for the V-22 are not as apparent. The aircraft is capable of self-deployment to virtually any area on earth. For logistics planners this is particularly desirable since the tiltrotor can relieve all nodes of strategic lines of communication by deploying directly to the battlefield. During Desert Shield/Storm such a capability could have made a critical difference on the battlefield and on a hard-pressed logistics system. For operational planners, the reach of the V-22, and its ability to deliver troops in almost any terrain, brings new depth and new possibilities to the battlefield.

As the capabilities of tiltrotor aircraft are expanded, and if history is any indicator such improvements will occur, new tactical opportunities will surface. As the ability to carry men and equipment is increased and new variants are introduced, the possibility of fielding a self-contained aviation combat unit can finally be

realized. In one stroke an entire strike force, trained and equipped for the purpose, could depart its base of operations, seize an objective in rough terrain and hold it without relying on external support.

In an age when naval warfare planners turn their focus from blue water to littoral warfare, it is surprising that many do not fully recognize the potential that exists in tiltrotor technology. From ships far out at sea, this aircraft can touch any shore, and any ship, at any time. No capitol or major population center will be beyond the reach of naval forces that employ tiltrotor aircraft. The V-22 will enable U.S. forces to reach any point on the globe without depending on airfields and without changing the current deployment strategy that supports forward presence.

## CHAPTER III

## CONCLUSIONS

THE VALUE OF THE LONG VIEW. ***"The single most frequent failure in the history of forecasting has been grossly underestimating the impact of technologies."*** Peter Schwartz, The Art of the Long View.[37]

Tiltrotor technology, like so many revolutionary weapons before it, threatens the status quo. But unlike our predecessors, we must somehow overcome this perceived threat and combine the operational art with the art of the long view. As

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[37] Peter Schwartz, The Art of the Long View (New York: Doubleday, 1991), p. 173.

history clearly demonstrates, the government organizations, civil and military, that must deal with such emerging technologies are very good at confusing, ignoring and delaying a decision until dire emergencies force the issue. Or, as Samuel Johnson once said, "there is nothing like a death sentence for clearing the mind."[38] The V-22 is such a prime example of this organizational phenomenom that some have found that the bureaucratic confusion in dealing with the Osprey is, in itself, worthy of study.[39] In the post-McNamara era, one of the many tools used for delay and obfuscation by bureaucracies is the application of cost effectiveness measurements. The V-22 has been side-tracked for years by bureaucrats wielding such tools. But cost effectiveness is not necessarily a good indicator of operational effectiveness. Martin Van Creveld has emphasized this point:

> Whichever way one looks at it, the conclusion is always the same. The conduct of war against an intelligent opponent differs from the management of a large-scale technological system precisely in that efficiency and effectiveness, the concentration and employment of the greatest possible force on the one hand and military success on the other, are not the same even in the short run, or (one might well argue) particularly in the short run. On the contrary, there are any number of occasions when military effectiveness is not only compatible with diminished efficiency but positively demands that it be sacrificed.[40]

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[38] Samuel Johnson, quoted in Van Creveld, p. 222.

[39] For the long and ugly history of the development of the V-22 see Dean G. Sedivy's study listed as note 33.

[40] Van Creveld, p. 318.

Even though the Cold War has ended, the United States is still pursuing the B-2 bomber and the Seawolf submarine. In spite of any statistics that show the cost effectiveness of these weapons, what broad use will military planners find for such specialized technology? Recent studies indicate the philosophy that must be applied to answer such questions:

> This means that the United States must make hard trade-offs as to which technologies to preserve or acquire that are founded on as comprehensive an analysis of force-wide capabilities in a wide range of contingencies as possible.[41]

Clearly, tiltrotor technology provides just such broad capabilities and will play an important role in any future contingency imaginable.

As with any revolutionary technology, the V-22 will be limited only by the vision of those who would employ it. It will depart from the old world and cross over to a new realm, into an undiscovered country.

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[41] Anthony H. Cordesman, Compensating for Smaller Forces: Adjusting Ways and Means Through Technology, Strategy and Technology, Strategic Concepts in National Military Strategy Series (Carlisle Barracks, PA: Strategic Studies Institute, April 1, 1992), p. 9.

## BIBLIOGRAPHY


Alford, Jonathan, ed. The Impact of New Military Technology. New Jersey: Allanheld, Osmun & Co., 1981.

Bartlett's Familiar Quotations. (CD-ROM: Microsoft Bookshelf, 1993).

Chinn, George M. The Machine Gun. Washington: US Government Printing Office, 1991.

Clausewitz, Carl Von. On War. Princeton: Princeton University Press, 1984.

Cordesman, Anthony H. Strategy and Technology. Carlisle Barracks, Pa: Strategic Studies Institute, April 1, 1992.

Ellis, John. The Social History of the Machine Gun. New York: Pantheon Books, 1975.

Fuller, J.F.C. Armament and History. New York: Charles Scribner's Sons, 1945.

Greer, Thomas H. The Development of Air Doctrine in the Army Air Arm, 1917-1941. Maxwell Air Force Base: Air University, 1955.

Handel, Michael I., ed. Clausewitz and Modern Strategy. New Jersey: Frank Cass & Co. Ltd., 1986.

Hughes, Wayne P. Fleet Tactics. Annapolis: Naval Institute Press, 1987.

Schwartz, Peter. The Art of the Long View. New York: Doubleday, 1991.

Sedivy, Dean G. Bureaucracies at War: The V-22 Osprey Program. Washington: The Industrial College of the Armed Forces, 1992.

U. S. Joint Chiefs of Staff. Joint Pub 1, Joint Warfare of th US Armed Forces. Washington: National Defense University Press, 1991.

Van Creveld, Martin. Technology and War. New York: The Free Press, 1989.